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Review

Establishment and Development of Pasture, Rangeland and Grazing Reserves for Ruminant Production in Tropical Africa: A Review

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The objective of the paper was to review the establishment and development of pasture, rangeland and grazing reserves for ruminant production in tropical Africa. Establishing a new pasture or renovating an existing pasture usually requires some management practices to get the forage grow quickly and vigorously. These include soil testing, correcting soil nutrient deficiencies, selecting species adapted to the specific area, implementing the correct seeding method and rate, implementing a weed control programme and using proper management to maintain a productive stand. Normally, in places where there are large expanses of land, land can be selected for establishment of pasture, range and grazing reserves just like selection of land for production of any other food crops. However, in situation where land is scarce, land which is unsuitable for crop production may be utilized as pasture, range and grazing reserves. This may include mountain slopes, arid lands, and plateaux. The success of improved pasture species is dependent on the availability of good quality seeds or planting materials. Harvesting and processing of pasture seeds are done with the aid of combine harvesters, binders, grain separators, strippers and sickles. In spite of the infertile soils and hostile climatic environment, ruminant livestock survival in Northern Nigeria largely still depends on the extensive native pastures, browses and crop residues found across and within the various agro-ecological zones. Nigeria's forage and fodder species vary widely and are spread across the major agro-ecological zones of the country. Extensive areas of Nigeria's grazing lands are composed of indigenous forage species with their various botanical characteristics. Most of the species grown, until recently, are of the indigenous or local varieties that often have very low yields. Long periods of cropping, rough topography and frequent bush burning, among other factors, have given rise to mixed tree, shrub and grass vegetation in the savannah zones of the country. The grasses are composed of both annuals and perennials, and the trees show features characteristic of plants growing in low rainfall areas. Various nutrients and minerals, such as nitrogen, phosphorus and potassium among others, have also been found to be a key limiting factor in the proper development of forage and fodder crops, and hence the efficient utilization of these crops by livestock. The rate of acceptability of forage is related to the readiness to which the forage is selected and consumed.

Keywords: Establishment, Pasture, Rangeland, Grazing Reserves, Ruminant, Tropical Africa.

INTRODUCTION

Nigeria has a land area of 92.4 million hectares of which about 44% are under permanent pastures that supports its domestic ruminants of over 101 million (FMAWR, 2008). It is estimated that, only about 3% of this number of animals are reared on improved pastures (intensive management); the remaining 97% are raised on low nutrient native pastures and farmlands (under extensive management) as described by Okorie and Sanda (1992). According to Kallah (2004), grazing lands in Nigeria, including natural wetlands (fadama), grass and woodlands and forest reserves are estimated to cover about 32.42 million hectares, while cultivated crop-lands amount to about 39.41 million hectares. These lands provide substantial amount of forage and fodder as major sources of feed for the country's ruminant livestock, both domestic and wildlife (Kallah, 2004; FMAWR, 2008; Obua et al., 2012).

In Nigeria, forage quality and availability vary greatly from season to season, which affects the output of the animals (Olivo et al., 2013). The nutritive value of pastures fall rapidly with maturity and during the dry season the available feed is lignified. Likewise, protein, nitrogen, sulphur, vitamins and other nutrients are limited in grassland pastures during the dry season, while fibre is high with dry matter content of more than 30%. The nutritive value of any feedstuff is determined by its chemical composition and its digestibility and this is related to the forage and its environment. The rate of acceptability of forage is related to the readiness to which the forage is selected and consumed.

In spite of the infertile soils and hostile climatic environment, ruminant livestock survival in Northern Nigeria largely still depends on the extensive native pastures, browses and crop residues found across and within the various agro-ecological zones. Nigeria's forage and fodder species vary widely and are spread across the major agro-ecological zones of the country (Skerman and Riveros, 1990; Okorie, 1992; Humphreys, 1999). Extensive areas of Nigeria's grazing lands are composed of indigenous forage species with their various botanical characteristics. Most of the species grown, until recently, are of the indigenous or local varieties that often have very low yields (Shiawoya and Tsado, 2011; Nweze et al., 2012). Long periods of cropping, rough topography and frequent bush burning, among other factors, have given rise to mixed tree, shrub and grass vegetation in the savannah zones of the country. The grasses are composed of both annuals and perennials, and the trees show features characteristic of plants growing in low rainfall areas. Various nutrients and minerals, such as nitrogen, phosphorus and potassium among others, have also been found to be a key limiting factor in the proper development of forage and fodder crops, and hence the efficient utilization of these crops by livestock (Shiawoya and Tsado, 2011; Nweze et al., 2012). The objective of the paper was to review the establishment and development of pasture, rangeland and grazing reserves for ruminant production in tropical Africa.

ESTABLISHMENT OF PASTURE, RANGELAND AND GRAZING RESERVES

Establishment of a new pasture is really a time-consuming venture and highly expensive process (Lee, 2008). Pastures must be well established to be highly productive. Before establishing new pastures or renovating existing pastures, producers must evaluate the farm's forage needs. It is important to consider whether the forage will be used for grazing or hay, what forage species are best suited for the area and what resources are available in terms of equipment, money and time. The decision of whether or not to renovate a pasture should be based on existing percentages of the desirable species present in the pasture (Lee, 2008; Blanchet e al., 2003). The following criteria could be used in such a decision:

If the pasture contains 75% or more desirable species, consider not renovating and instead concentrate on management. If the pasture contains 40 to 75% desirable species, consider over-seeding while concentrating on management. If the pasture contains less than 40% desirable species, consider re-establishing.

Establishing a new pasture or renovating an existing pasture usually requires some management to get the forage grow quickly and vigorously. Here are some of the steps involved in establishing or renovating a pasture:

(i) Soil testing and correcting soil nutrient deficiencies,
(ii) Selecting species adapted to the specific area,
(iii) Implementing the correct seeding method and rate,
(iv) Implementing a weed control program,
(v) And using proper management to maintain a

Figure 1. Electric Fencing of Pasture.

Figure 2. Wooden Fencing of Pasture

productive stand.

Selection of Land for Establishment of Pasture, Rangeland and Grazing Reserves

Normally, in places where there is large expanses of land, land can be selected for establishment of pasture, range and grazing reserves just like selection of land for production of any other food crops. But in situation where land is scarce, land which is unsuitable for crop production may be utilized as pasture, range and grazing reserves. This may include mountain slopes, arid lands, and plateaux (Lee, 2008).

Fencing and Dividing Pasture Land into Paddocks

Pasture, range and grazing reserves may be fenced or divided into paddocks for efficient forage utilization and prevent stray animals from grazing as shown in Figures 1 and 2. These, also, help the forage crops regenerate as rotational grazing is employed. Disease and parasites are, also, controlled (Allen, and Collins, 2003; Allen et al., 2007; Shiawoya and Tsado, 2011; Nweze et al., 2012). The grazing land can be fenced and divided into paddocks using either electric fences, ordinary fence with wire, stones and fence plants especially in plateau state and other places with enough stones (Lee, 2008; Blanchet et al., 2003).

Soil Fertility Testing

Planning for a successful pasture establishment or renovation should begin well in advance, often 6 to 12months before the actual pasture establishment or renovation. If possible, adjust soil fertility before seeding. With today's high fertilizer prices, you cannot afford to guess how much fertilizer to apply. The first step is to obtain an accurate soil sample. If you plan to apply manure, it is important to note that fact in the soil sample sheet so the recommendations will reflect the nutrient contributions from manure (Lee, 2008).

Using soil test recommendations incorporates necessary fertilizer during seed-bed preparation. Avoid applying fertilizer to drought-stressed seedlings, as the application could cause burning injury to young seedlings already under stress. Soil acidity often limits forage production in some locations. Acidic conditions reduce nutrient availability, root growth, and nitrogen fixation of legumes. For forages to be productive, grass pastures should be maintained at a pH of 5.8 to 6.2. Legume pastures should have a pH of 6.0 to 6.8. To maintain the ideal pH, lime application might be necessary. It could take years to correct severe soil acidity. If lime is needed, it should be applied 6 to 12months before seeding to allow for the pH to adjust in the root zone, which will maximize the use of nutrients. Wherever it is practical, incorporate the lime into the soil rather than leaving it on the soil surface (Lee, 2008).

Liming does not only correct soil acidity, but also supplies calcium and magnesium to the soil. It reduces the availability of toxic nutrients such as

Figure 3. Mechanical Seedbed Preparation.

aluminium and manganese. Lime affects the availability of most of the other essential elements needed for forage production. For example, phosphorus availability increases as the pH increases. New seedlings in particular require sufficient levels of available phosphorus and potassium to get established. Any nutrient deficiencies will compromise the success of the stand.

Proper phosphorous (P) application at seeding time is the key element in establishing grasses and legumes. Phosphorus encourages root development, particularly lateral and fibrous root formation. Quick root development is especially important when establishing forages in the fall. Well-developed root growth will minimize dry season injury and allow rapid growth in the wet season. Potassium is essential for plants to cope with heat and water stress. It is, also, essential for plant growth and reproduction. Legumes require high potassium levels; low potassium levels can contribute to legume loss. Nitrogen is best applied in small, frequent applications when plants are actively growing. Nitrogen, along with proper defoliation management, stimulates tillering in grasses.

Land Preparation for the Establishment of Pasture, Range and Grazing Reserves

Land preparations involves ploughing and harrowing after land clearing to produce a fine tilt soil, especially if seeds are to be used for propagation. This is best achieved in the dry season so that weeds are allowed to dry (Lee, 2008).

Seedbed Preparation

Good seed-to-soil contact is essential to maintain adequate moisture near the seeds. This moisture is necessary for germination and for the small root systems of young grass seedlings. The best type of seed-bed preparation depends on the type of equipment available and whether a new pasture is being established (conventional tillage) or an existing pasture is being renovated (no-till drill) as can be seen in Figure 3.

Conventional Tillage

A properly prepared seed-bed is a key step in pasture establishment. Conventional tillage should be used when a uniform seed-bed is needed. Large soil clods and excess sod impacts seed germination. For conventional seeding, prepare a fine and firm seed-bed by disking. Roll the field with a cultipacker after the final disking. A firm seed-bed will allow capillary action to draw water to the soil surface, where moisture helps to germinate seeds and sustain small seedlings during periods of dry weather. A firm seed-bed may help ensure that seed is not planted too deeply, which usually results in poor seedling emergence and weak pasture establishment. A general rule is that, if you walk across the seed-bed and you sink past the sole of your shoe more than ¼ inch, the seed-bed is too soft and should be cultipacked.

Forages usually establish more quickly and uniformly in conventional seed-bed than in no-till established pastures. Conventional tillage seed-

Figure 4. Mechanical Reseeding.

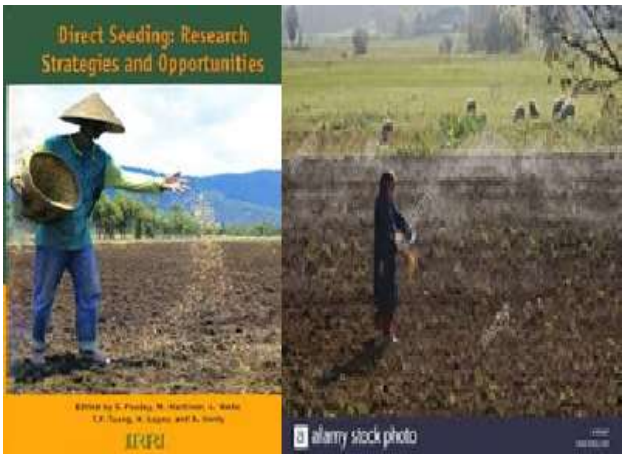

Figure 5. Manual Reseeding.

beds, also, warm more quickly, allowing for better seed germination at cool temperatures. However, conventional tillage may cause soil erosion, changes in soil structure, and reduced moisture retention.

No-Till Seed-bed

No-tillage involves using herbicides to kill existing vegetation and then seeding directly into the residue. Surface residue must be reduced in no-till seed-beds by herd grazing or hay removal; most no-till seed-beds are prepared in late dry season and planted in wet season. No-tillage seed-beds reduce the possibility of soil erosion, and conserve moisture. On the other hand, seedlings in no-till seed-beds emerge more slowly and less uniformly (Lee, 2008).

Species Selection

Selecting the right species or species mixture is extremely important. When establishing or renovating a pasture, it is important to match forage species to the site, soil type, and type of operation (grazing or hay, animal species and class). Check soil survey maps to find out your soil types, soil composition, drainage, and forage capability. This information can be used to predict the success or failure of a potential forage species (Lee, 2008). Seasonal yield distribution is another factor to consider when making species selections. It is important to try to match the forage yield distribution with the animals' daily requirements.

Legumes are, also, an important part of the establishment process because they can provide nitrogen to the grasses, increase production and pasture quality.

Seeding Methods

The ideal seeding method depends on the type of equipment available and whether you plant on a no-till or a conventional seed-bed. To ensure good soil-to-seed contact, seed germination, and timely emergence, different seeding methods are available. Some of these methods include drilling, cultipacking, and broadcasting as shown in Figures 4 and 5. Drilling cuts a thin furrow in the soil, deposits the seed, then covers it and firms the soil with press wheels. A good rule is to plant the seed three to four times as deep as the diameter of the seed (Lee, 2008).

With a cultipack planter, the seed is dropped from a hopper onto the soil, where toothed rollers press the seed below the surface. When cultipacker is used, care must be taken not to bury the seed too deeply, decreasing germination. The Brillion limits seed depth by the depth of the teeth; seeding depth can be adjusted by the firmness of the soil. Broadcast seeding with a fertilizer spreader can result in an uneven seed distribution if the overlap is too wide. Make sure the spreader is calibrated for the appropriate seeding rate. When broadcasting, increase recommended seeding rates by 20%. Roll with a cultipacker to establish a good soil-to-seed contact.

Seeding Time

Seeding on the correct date is, also, very important.

Figure 6. Mechanical Weed Control.

Figure 7. Manual Weed Control.

Pasture forages are established during the onset of rains (June/July). At this period, the soil has reached a temperature of 65 °F or above. Seeds planted in wet season usually have plenty of moisture for germination, but they sustain increased weed pressure (Lee, 2008).

Seeding Rates

Planting is done at the beginning of the rainy season in rows or drill with a spacing of 15cm-45cm apart depending on species. Seeds may be broadcast. To obtain a good establishment, use seed that is pure with a high germination rate which has not been stored for a long period of time. High quality, certified seed is recommended. Seed cost could be a major portion of the total establishment cost, but buying less expensive seed does not always translate into savings. If the seed is of poor quality, it must be applied at higher rates to obtain a desirable stand, making the use of cheap seed with low quality is neither agro-nomically nor economically sound (Lee, 2008).

Legume seed is often pre-inoculated with the proper bacterial strain. If the seed is not pre-inoculated then mix packaged inoculum with the seed just before seeding. Make sure that the inoculants have been stored properly. Legumes form a symbiotic relationship with Rhizobium bacteria in which the bacteria fixes nitrogen from the air into a plant-available form. There is no need for nitrogen fertilizer when legumes make up more than 30% of the pasture. It is vital to have proper seeding depth and seed coverage. When drilling method is to be used for legume seeds, be sure to plant not deeper than 2inches, depending on the seed type and size. Planting depths greater than 2inches will decrease seedling emergence as much as 50% in some forage species.

Weed Control

A weed management plan will help ensure success in forage establishment. It is important to control weeds during establishment because newly emerged forage seedlings are extremely susceptible to weed competition as shown in Figures 6 and 7. Weeds compete for water, nutrients, and sunlight. Broad-leaf weed control is possible but may require multiple applications of herbicide or applications at different times of the year (Shiawoya and Tsado, 2011; Khobe, 2011; Nweze et al., 2012). Applications at different times during the year will better control weeds that germinate during different seasons (Lee, 2008).

Management of Newly Established Pastures

Do not allow animals to graze new stands too early or too frequently. Allow plants to become well established before heavy grazing or set-stocking. Mow or lightly graze pastures when plants are 8 to 12inches tall. Most forage crops should not be grazed shorter than 3 to 4inches. Maintaining proper grazing height will help trigger new plants to tiller or produce runners. Allow plants to grow to 8 to 12inches before grazing or mowing again. A rotational grazing approach could be beneficial in ensuring successful establishment (Montana, 1999; Gerrish, 2004; Lee, 2008).

Seed Production

The success of improved pasture species is dependent on the availability of good quality seeds

or planting materials. Until recently, pasture establishment has not been given much attention because many people don't know that, there are pasture seeds that can be used to establish desired pasture plants. With growing knowledge of pasture establishment, seed has been found to be in short supply (Lee, 2008).

Pasture seed production is a specialized farm enterprise with the combination of knowledge, skill and timeliness of operations leading to satisfactory production. There are other reasons pasture seed production is not given much attention as a regular cropping practice. Pastures are grown primarily for hay, silage or green manure, thus until forage requirements are met, seed production is secondary.

The potential yield of a crop is limited by: The density of flowers produced. This is in turn dependent on the degree of branching which is determined by plant density, soil moisture and nutrient content. The proportion of the surviving shoots which are fertile. Harvesting efficiency of many pasture seed crops is very low because: Flowering proceeds over a long period, seeds of many pasture crops drop to the ground soon after they ripen. Only a small proportion of the seeds produced may be recovered at harvest.

Successful pasture seed production depends on the following: Choice of site for seed production: The choice of location is very important in seed production. A bad location can result in a total failure of the enterprise. Weather is, also, a very important factor in seed production. High plant seed yields are not usually recorded in high rainfall and low radiation areas where flowering is restricted and diseases flourish. On the other hand, bright, dry weather is conducive for blooming. It accelerates activities of pollinating insects, pollination and seed setting. The seed production field must be isolated from potential contaminants. An isolation distance of 20m may be adequate to prevent mechanical contaminations. Cross pollinated crops such as *Setaria anceps* should be spaced about 100-200m from contaminating varieties of the same species (Shiawoya and Tsado, 2011; Khobe, 2011; Nweze et al., 2012).

Seeding practices for seed production: Practices favourable to the establishment and maintenance of productive stands for use as forage seasonally apply for seed production. There is, however, some practices that are more important for seed production than for forage production. These are the control of weeds and planting density. Weeds are generally a problem for seed producers. Selection of field which are possibly free from weeds and weed seeds is one of the first pre-requisites for successful pasture seed production. Investment in weed control is also necessary since weed seeds may lower the quality of harvested seeds when they cannot be removed during harvesting or seed processing.

The weed hazard may be reduced by using one or more of the following (Bradley et al., 2010): Growing clean cultivated row crops, fallow land for one or more years, use of chemical weed killers, careful site selection can prevent weed problems. Virgin grass-land sites cause fewer problems for the seed producers than old cultivated sites. Plant density also plays an important role in the amount of seed produced. Where plant density is too high or low, seed yield is lower than when planted at optimum planting density. This is very important in legumes sown for seed production. The number of inflorescence formed per unit area is the most important factor controlling yield. At lower seed planting seed densities, there would be shortage of inflorescence while at very high densities, above optimum, there is a reduction in floret number per inflorescence resulting in low seed yield. Hence, for optimum seed production, the right seed rate should be used. Grasses can be sown in rows as this makes weed control easier. Also, spacing has been found to affect seed yield (Shiawoya and Tsado, 2011; Khobe, 2011; Nweze et al., 2012).

Fertilizer and management: There are evidences that, the use of nitrogenous fertilizer will increase the seed yield of grasses. A range of 100 to 200kg of nitrogen/ha with enough soil moisture is recommended. For legumes, the application of 200kg single superphosphate (SSP) is desirable. Attention should be given to boron and copper availability, since seed crops are more sensitive to their deficiency than grazing crops. Application of fertilizer at the beginning of the growth phase is more effective than application during crop development phase. However, in light soil, split application may be necessary to reduce the effects of leaching of the nutrients. Grazing or cutting pasture seed crops may be beneficial or dangerous depending on the crop involved. There is need to study carefully individual crop development pattern before grazing or cutting. Cutting in some species is essential to stimulate flowering while in others, cutting delays flowering and may be harmful

Figure 8. Manual Harvesting.

Figure 9. Mechanized Harvesting.

Figure 10. Manual Threshing.

Figure 11. Manual Winnowing.

depending on the maturation period and environmental conditions. Late cutting or grazing which removes flowering parts may be harmful but early cutting or grazing may stimulate branching and the generation of more sites for flower production when such grazing is not too severe to decrease crop growth rate.

A general rule in seed production is that, grazing should be stopped 8 to 12 weeks before seed is harvested for sole grass, legume or mixed grass-legume farms.

Harvesting and Processing of Seeds

Harvesting and processing of pasture seeds are done with the aid of combine harvesters, binders, grain separators and strippers. However, this is only achieved in developed countries where all facilities for the harvesting and processing are available. In countries like Nigeria, pasture seeds harvesting and processing are usually done manually because of lack of equipment. Harvesting and processing of pasture seeds are done like any other food crop such as benni seed, soya beans, rice etc as shown in Figures 8, 9, 10, 11, 12 and 13.

Forage crops like *Chloris gayana* will shed their seeds upon drying, therefore, total drying is not allowed before the stems carrying the flowers are cut with sickle. This is an example of where skill and timeliness are needed to harvest seeds. The cut stems with inflorescence are piled up under a shade for drying to continue on a concrete floor. They are turned twice a day to allow for even and faster drying. After the stems are dried, they are threshed by beating with a stick gently to avoid shattering. In the process of beating, the seeds are shed. After satisfactory seed shedding is realised, the stems are shaken thoroughly to allow complete dropping of the seeds. The stems and chaffs are then carefully removed leaving the seeds on the floor. These seeds are left on the floor for more days to achieve complete drying. This is followed by winnowing to remove leaves and chaffs and the clean seeds are then bagged.

The seeds of forage crops like Stylosanthes species are allowed to dry and drop on the field (Table 1). The forage is cut and removed. The seeds that dropped on the ground are then swept with brooms. In the process of sweeping, sand and other chaffs are collected with the seeds. The sand and trash are removed by repeated winnowing using calabash and containers until clean seeds are left. The collected seeds are properly marked or labelled

Figure 12. Cleaning and Sorting.

Figure 13. Different Varieties of Forage Seeds.

Table 1. Sowing Rate of Some Forage Species.

Botanical Name	**Common Name**	**Sowing Rate (kg/ha)**
Grasses		
Andropogon gayanus	Gamba grass	40 – 60
Brachiaria decumbens	Signal grass	5 – 10
Brachiaria ruziziensis	Rusi grass	5 – 10
Cenchrus ciliaris	Buffel grass	3 – 15
Chloris gayana	Rhodes grass	5 – 20
Hypaahenia rufa	Jaragud grass	30 – 40
Melinis minutiflora	Molasses grass	5 – 25
Panicum maximum	Guinea grass	4 – 10
Pennisetum pedicellatum	Annual kyasuwa grass	8 – 15
Setaria anceps	Setaria grass	2 – 7
Urochloa mosambicensis	Sabi grass	2 – 10

with date of collection and stored in clean, cool and well ventilated store.

Table 1. Continue.

Legumes		
Arachis hypocaea	Groundnut	20 – 90
Cajanus cajan	Pigeon pea	10 -25
Centrosema pubescens	Centro	5 – 10
Desmodium intorium	Greenleaf desmodium	2 – 5
Glycine max	Soya bean	30 – 65
Lablab purpureus	Lab lab bean	10 – 25
Leuceana leucocephala	Leucaena	10 – 40
Stylosanthes guianensis	Cook stylo	2 – 6
Vigna unguiculata	Cowpea	25 – 75
Pueraria phaseoloides	Puero	3 – 10
Stylosanthes humilis	Townsviile stylo	3 – 7

CONCLUSION AND RECOMMENDATIONS

It is concluded that, establishing a new or renovating an existing pasture usually requires some management practices such as soil testing and correcting soil nutrient deficiencies, selecting species adapted to the specific area, implementing the correct seeding method and rate, implementing a weed control programme and using proper management to maintain a productive stand. In places where there are large expanses of land, land can be selected for establishment of pasture, range and grazing reserves just like selection of land for production of any other food crops. But in situation where land is scarce, land which is unsuitable for crop production may be utilized as pasture, range and grazing reserves. The success of improved pasture species is dependent on the availability of good quality seeds or planting materials. Harvesting and processing of pasture seeds are done with the aid of combine harvesters, binders, grain separators and strippers. Ruminant livestock survival in Northern Nigeria largely still depends on the extensive native pastures, browses and crop residues found across and within the various agro-ecological zones. Extensive areas of Nigeria's grazing lands are composed of indigenous forage species with their various botanical characteristics (Table 1). Most of the species grown, until recently, are of the indigenous or local varieties that often have very low yields. Long periods of cropping, rough topography and frequent bush burning, among other factors, have given rise to mixed tree, shrub and grass vegetation in the savannah zones of the country. The grasses are composed of both annuals and perennials, and the trees show features characteristic of plants growing in low rainfall areas. Various nutrients and minerals, such as nitrogen, phosphorus and potassium among others, have also been found to be a key limiting factor in the proper development of forage and fodder crops, and hence the efficient utilization of these crops by livestock. The rate of acceptability of forage is related to the readiness to which the forage is selected and consumed.

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REFERENCES

Allen VG and Collins M (2003). Grazing management systems. Pp. 473–501. In R.F Barnes et al. (ed.), Forages: An introduction to grassland agriculture. 6th ed. Iowa State Press, Ames, IA.

Allen VG, Heitschmidt RK and Sollenberger LE (2007). Grazing systems and strategies. Pp. 709–729. In R.F Barnes et al. (ed.), Forages: The science of grassland agriculture. 6th ed. Blackwell, Ames, IA.

Blanchet K, Moechnig H and DeJong-Hughes J (2003). Grazing Systems Planning Guide. St. Paul: University of Minnesota Extension Service.

Bradley K, Kallenbach R and Roberts CA (2010). Influence of seeding rate and herbicide treatments on weed control, yield and quality of spring-seeded glyphosate-resistant alfalfa. Agron. Journal, 102: 751–758.

FMAWR (2008). Federal Ministry of Agriculture and Water Resources, Federal Republic of Nigeria, Draft National Security Programme, Pp.107.

Gerrish J (2004). Management-intensive Grazing: The Grassroots of Grass Farming. Ridgeland, MS: Green Park Press.

Humphreys LR (1999). Tropical Pastures and Fodder Crops (2nd ed.); Intermediate Tropical Agricultural Series. (Ed. W.J.A. Payne), Longman Science and Technical, U.K. Pp. 155.

Kallah MS (2004). Rangelands in Nigeria: A Partial Resource Appraisal Towards Improving Livestock Production. In: Forage Production and Management in Nigeria, eds. J. O. Gefu and J. T. Amodu, National Animal Production Research Institute. Ahmadu Bello University, Zaria, Nigeria, Pp. 1-10.

Khobe D (2011). Species composition and range condition of Jibiro Grazing Reserve, Adamawa State, Nigeria. Global Journal of Science Frontier Research, 11 (9): 21-24.

Lee R (2008). Pasture, Rangeland and Grazing Management. A Publication of ATTRA, National Sustainable Agriculture Information Service. Pp 1-20.

Montana DNRC (1999). Best Management Practices for Grazing in Montana. Helena, MT: Montana Department of Natural Resources.

Nweze BO, Ekwe OO, Alaku SO and Omeje SI (2012). Productivity of two indigenous Nigerian cattle breeds and their crossbred under range grazing management. World Journal of Life Sci. and Medical Research, 2 (1): 1 - 8.

Obua BE, McAlbert FU, Okoro BO and Efrenie S (2012). Survey of the Diversity of Forage Plants Used in Feeding Pigs in Small-holder Farms in South-Eastern Nigeria. Int. J. Agric. Rural Dev., 15 (3): 1310-1316.

Okorie AU and Sanda LU (1992). Rangeland and grazing reserve in Nigeria: Livestock sub-sector review. FAO (Food and Agriculture Organization), Rome, 2: 2-15.

Olivo CJ, Aguirre PF, Araujo TL da R de, Diehl MS, Bem CM de, Serafim G, and Correa M da R (2013). Productivity and Crude Protein of Elephant Grass Pastures Managed under Agro-Ecological and Conventional Systems. Ciencia Rural, 43 (8): 1471-1477.

Shiawoya EL and Tsado DN (2011). Forage and fodder crop production in Nigeria: Problems and prospects. World Journal of Life Sci. and Medical Research,1 (4): 88.

Skerman PJ and Riveros F (1990). Tropical Grasses. FAO Plant Production and Protection Series No. 23, FAO, Rome.